CLAIMS

1. A nucleic acid molecule encoding a fusion polypeptide useful as a vaccine composition, which molecule comprises:

(a) a first nucleic acid sequence encoding a first polypeptide or peptide that promotes processing via the MHC class I pathway;

(b) fused in frame with the first nucleic acid sequence, a second nucleic acid sequence encoding a signal peptide; and

(c) a third nucleic acid sequence that is linked in frame to said first nucleic acid sequence and that encodes an antigenic polypeptide or peptide.

2. The nucleic acid molecule of claim 1, wherein the antigenic peptide comprises an epitope that binds to a MHC class I protein.

3.. The nucleic acid molecule of claim 1 wherein the first polypeptide or peptide is Hsp70, an active C-terminal domain thereof, or a functional derivative of Hsp70 or of said C-terminal domain.

4. The nucleic acid molecule of claim 1, wherein the first polypeptide is encoded by SEQ ID NO:9 or a fragment thereof that encodes a functional derivative of said polypeptide or the full length sequence of Hsp70 a set forth in GENBANK Z95324 AL123456 and encoded by nucleotides 10633-12510 of the *Mycobacterium tuberculosis* genome.

5. The nucleic acid molecule of claim 1, wherein the first polypeptide is SEQ ID NO:10 of a functional derivative thereof.

6. The nucleic acid molecule of claim 1 wherein the antigen is one which is present on, or/ cross-reactive with an epitope of, a pathogenic organism, cell, or virus.

7. The nucleic acid molecule of claim 6, wherein the virus is a human papilloma virus.

8. The nucleic acid molecule of claim 7, wherein the antigen is an E7 polypeptide of HPV-16 having the sequence SEQ ID NO:2, or an antigenic fragment thereof.

9. The nucleic acid molecule of claim 8, wherein the HPV-16 E7 polypeptide is a non-oncogenic mutant or variant of said E7 polypeptide.

10. The non oncogenic mutant of claim 9 wherein the sequence of the E7 polypeptide differs from SEQ ID NO:2 by one or more of the following substitutions:

(a) Cys at position 24 to Gly or Ala

(b) Glu at position 26 to Gly or Ala

(c) Cys at position 91 to Gly or Ala.

11. The nucleic acid molecule of claim 7, wherein the antigen is the E6 polypeptide of HPV-16 having the sequence SEQ ID NO:4 or an antigenic fragment thereof.

12. The nucleic acid molecule of claim 11, wherein the HPV-16 E6 polypeptide is a non-oncogenic mutant or variant of said E6 polypeptide.

13. The non oncogenic mutant of claim 12 wherein the sequence of the E6 polypeptide differs from SEQ ID NO:4 by one or more of the following substitutions:

(a) Cys at position 70 to Gly or Ala

(b) Cys at position 113 to Gly or Ala.

(c) Ile at position 135 to Thr

14. The nucleic acid molecule of claim 1 that is characterized as pNGVL4a-Sig/E7(detox)/HSP70, and has the sequence SEQ ID NO:13.

15. The nucleic acid molecule of claim 1 operatively linked to a promoter.

16. An expression vector comprising the nucleic acid molecule of any of claims 1-13 operatively linked to

(a) a promoter; and

(b) optionally, additional regulatory sequences that regulate expression of said nucleic acid in a eukaryotic cell.

17. An expression vector comprising the nucleic acid molecule of claim 14. operatively linked to

(a) a promoter; and

(b) optionally, additional regulatory sequences that regulate expression of said nucleic acid in a eukaryotic cell.

18. The expression vector of claim 16 which is a plasmid.

19. The expression vector of claim 18 wherein said plasmid is pNGV4a.

20. A pharmaceutical composition capable of inducing or enhancing an antigen-specific immune response, comprising:

(a) pharmaceutically and immunologically acceptable excipient in combination with;

(b) a composition comprising the nucleic acid molecule of any of claims 1-13.

21. A pharmaceutical composition capable of inducing or enhancing an antigen-specific immune response, comprising:

(a) pharmaceutically and immunologically acceptable excipient in combination with;

(b) the nucleic acid molecule of claim 14.

22. A pharmaceutical composition capable of inducing or enhancing an antigen-specific immune response, comprising:

(a) pharmaceutically and immunologically acceptable excipient in combination with;

(b) the expression vector of claim 16.

23. A pharmaceutical composition capable of inducing or enhancing an antigen-specific immune response, comprising:

(a) pharmaceutically and immunologically acceptable excipient in combination with;

(b) the expression vector of claim 19.

24. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 20, thereby inducing or enhancing said response.

25. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 21, thereby inducing or enhancing said response.

26. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 22, thereby inducing or enhancing said response.

27. A method of inducing or enhancing an antigen specific immune response in a subject comprising administering to the subject an effective amount of the pharmaceutical composition of claim 23, thereby inducing or enhancing said response.

28. The method of claim 24, wherein the response is mediated at least in part by $CD8^+$ cytotoxic T lymphocytes (CTL).

29. The method of claim 24 wherein said subject is a human.

30. The method of claim 25 wherein said subject is a human.

31. The method of claim 26 wherein said subject is a human.

32. The method of claim 27 wherein said subject is a human.

33. The method of claim 29 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.

34. The method of claim 30 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.

35. The method of claim 31 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.

36. The method of claim 32 wherein said administering is by a intramuscular injection by gene gun administration or by needle-free jet injection.

37. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 20, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.

38. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 21, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.

39. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 22, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.

40. A method of inhibiting growth or preventing re-growth of a tumor expressing HPV E7 or E6 protein in a subject, comprising administering to said subject an effective amount of a pharmaceutical composition of claim 23, wherein said third nucleic acid sequence encodes one or more epitopes of E7 or E6, thereby inhibiting said growth or preventing said re-growth.